

CLAIMS

We claim :

1 1. In a digital communications system including a first modem
2 operatively connected to a second modem through a digital
3 communications network with possible digital impairments of
4 repetitive nature, with repetition frame (RF) size of one or more
5 slots, said first modem including pad detection means for detecting
6 and measuring an actual value of programmed attenuation (PAD) in
7 the digital trunk , a PAD and CODEC detecting means for detecting
8 the type of Network CODEC at the digital trunk to analog loop
9 interface in the signal path from the second modem to the first
10 modem, said PAD and CODEC detection means comprising:

11 a. means for selecting a plurality of test values, where each
12 said test value corresponds to a PAD value;

13 b. means for selecting a one or more CODEC types, each of
14 said CODEC types corresponding to a particular CODEC type at the
15 digital to analog interface at the network;

16 c. means for calculating a minimum error between preprocessed
17 received signal values and the type of CODEC linear values for a
18 test PAD value;

19 d. means for calculating a PAD estimate based on the minimum
20 error; and

21 e. means for identifying CODEC type based on minimum error.

1 2. The PAD and CODEC detection means of claim 1, further
2 comprising:

3 means for iteratively selecting PAD test values until an
4 optimum minimum error is found.

1 3. The PAD and CODEC detection means of claim 1, further
2 comprising:

3 means for storing a plurality of PAD values corresponding to
4 different time slots in a repetition frame; and

5 means for grouping the PAD values into bins of similar values
6 and using the average of the PAD values in the most populated bin
7 to form the PAD estimate.

1 4. The PAD and CODEC detection means of claim 1, further
2 comprising:

3 means for storing a plurality of minimum errors corresponding
4 to different time slots in a repetition frame for a plurality of
5 CODEC types;

PATENT

6 means for summing the minimum stored errors for each type of
7 CODEC; and

8 means for selecting a CODEC type having a lowest summed
9 minimum error.

1 5. The PAD and CODEC detection means of claim 4, wherein the
2 CODEC is of type standard complaint mu-law or A-law encoding.

1 6. The PAD and CODEC detection means claim 1, wherein the
2 CODEC is of type D4 channel bank CODECs specified in AT&T Technical
3 Reference, PUB 43801, November 1982, said PAD and CODEC detection
4 means further comprises means for detecting the CODEC, by finding
5 a error maxima at the PAD estimate in the Robbed Bit Signaling
6 (RBS) time slot.

1 7. The PAD and CODEC detection means of claim 1, wherein the
2 summed absolute error is determined according to the equation:

$$Error_n = \frac{\sum_{n=Ucode72}^{Ucode105} |ReceivedSample_n \cdot TestFraction - SLICED[ReceivedSample_n \cdot TestFraction]|}{TestFraction}$$

3 for mu-law or A-law CODECs or type D4 channel bank CODECs
4 specified in AT&T Technical Reference, PUB 43801, November 1982.

1 8. The PAD and CODEC detection means of claim 1, further
2 comprising:

3 preprocessing means for preprocessing the received signal
4 corresponding to minimizing correlative analog impairments,
5 averaging noise and compensating for harmonic distortion.

1 9. The PAD and CODEC detection means of claim 1, further
2 comprising means for maintaining data integrity of receive values
3 in different time slots with repetitive digital impairments using
4 a reference symbol, training symbol interleaving method, and
5 updating adaptive loops and Decision Feedback Equalizer (DFE) pipe
6 during reference symbols reception periods and freezing the

7 adaptive loops, and updating the DFE using the received values in
8 the training symbols reception periods.

1 10. A method of operating a first modem operatively connected
2 to a second modem through a digital communications system with
3 possible digital impairments of repetitive nature, with repetition
4 frame (RF) size of one or more time slots, to measure
5 communications system pad and the network CODEC type at said first
6 modem for signals sent from said second modem, said method
7 comprising the steps of:

8 selecting a test PAD value,

9 selecting a CODEC type,

10 carrying out at said first modem a calculation of summing
11 absolute errors between average received values multiplied by said
12 test PAD value and the nearest CODEC linear values for the CODEC
13 type,

14 selecting a minimum absolute error based upon said
15 calculation,

16 calculating a PAD estimate based on said minimum absolute
17 error, and

18 identifying a network CODEC.

1 11. The method of claim 10, wherein said step of summing
2 absolute errors is repeated by selecting a test PAD values
3 iteratively to find said minimum error.

1 12. The method of claim 10, further comprising the steps of:
2 storing a plurality of PAD values corresponding to different
3 time slots in a repetition frame, and
4 grouping the PAD values into bins of similar values and using
5 the average of the PAD values in the most populated bin to form the
6 PAD estimate.

1 13. The method of claim 10, further comprising the steps of:
2 storing a plurality of minimum errors corresponding to
3 different time slots in a repetition frame for a plurality of CODEC
4 type,
5 summing the minimum stored errors for each type of CODEC, and
6 selecting a CODEC type having a lowest summed minimum error.

1 14. The method of claim 13, wherein the CODEC type is
2 standard mu-law or A-law encoding.

PATENT

1 15. The method of claim 10, wherein the CODEC is of type D4
2 channel bank CODECs specified in AT&T Technical Reference, PUB
3 43801, November 1982, said method further comprising the step of
4 detecting the CODEC by finding a error maxima at the PAD estimate
5 in the Robbed Bit Signaling (RBS) time slot.

1 16. The method of claim 10, wherein the impairment repetition
2 frame size is selected from 6 or 12 or 24.

1 17. The method of claim 10, wherein a first test PAD fraction
2 is selected to have a value of 1.0, and is incremented to a value
3 of .25, for repeated calculations of summing absolute errors.

- 1 18. The method of claim 10, wherein the summed absolute error
2 is determined according to the equation:

$$\text{Error}_n = \frac{\sum_{n=Ucode72}^{Ucode105} | \text{ReceivedSample}_n \cdot \text{TestFraction} - \text{SLICED} [\text{ReceivedSample}] |}{\text{TestFraction}}$$

- 3 for mu-law or A-law CODECs or type D4 channel bank CODECs
4 specified in AT&T Technical Reference, PUB 43801, November 1982.